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Electrochemical design of plasmonic nanoantennas for tip-enhanced optical spectroscopy and imaging performance

Kharintsev S., Alekseev A., Vasilchenko V., Kharitonov A., Salakhov M.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2015 Optical Society of America. Optical nanoantennas play a crucial role in controlling near-fields on the nanoscale and being counterparts of commonly used conventional optical components such as lens, prisms, gratings, etc. for shaping the wavefront of light in the far-field. In this paper we highlight a dc-pulsed voltage electrochemical etching method with a self-tuneable duty cycle for highly reproducible design of plasmonic (metallic) nanoantennas. With the method, we introduce such concepts as design, optimization and figure-ofmerit for evaluating fabrication efficiency. The ability of the nanoantennas to enhance and localize the optical fields beyond the diffraction limit is statistically studied with Rayleigh scattering from the tip apex and tipenhanced Raman spectroscopy of a single walled carbon nanotubes bundle.

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